

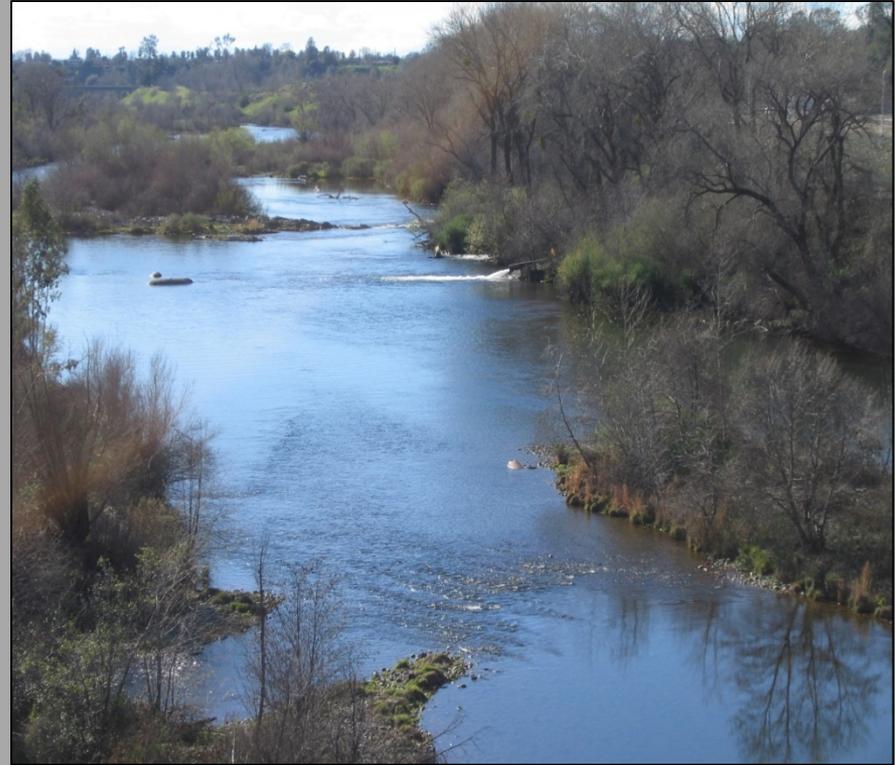
Predator Diet and Movement Patterns in the Lower Feather River and Their Effects on Hatchery Smolts

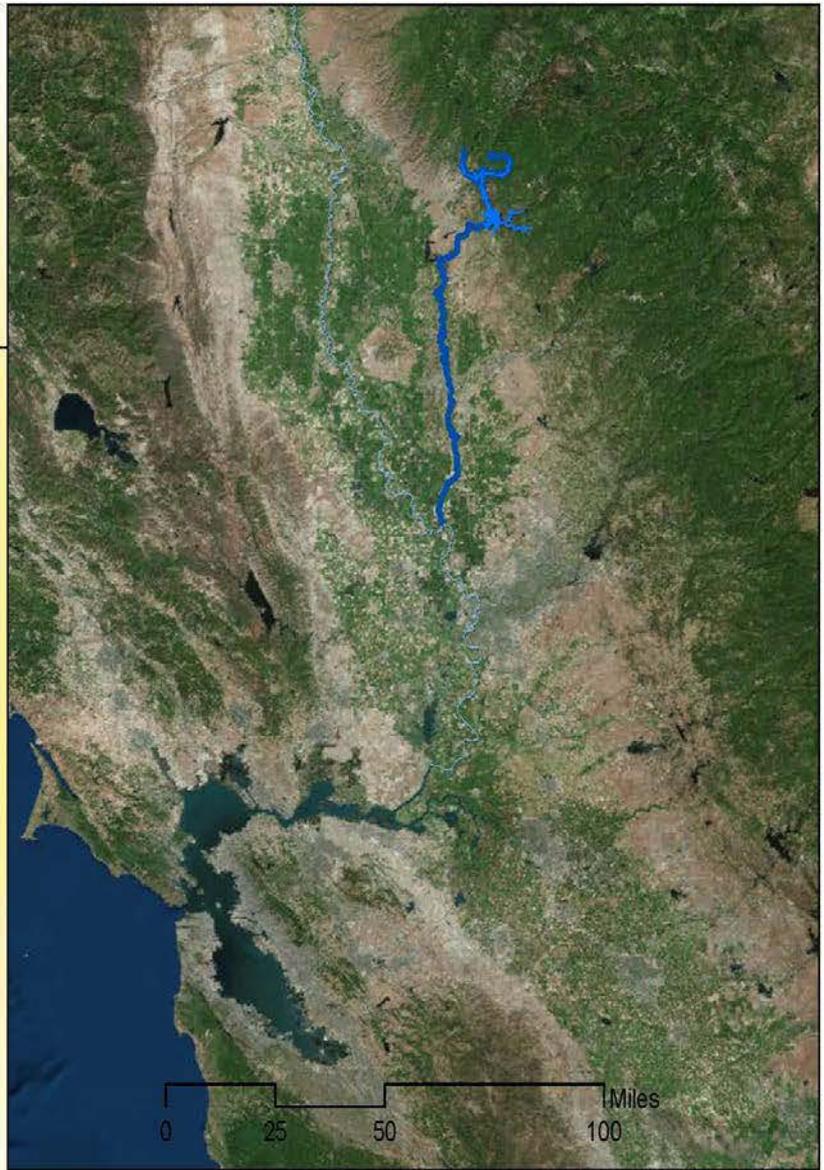
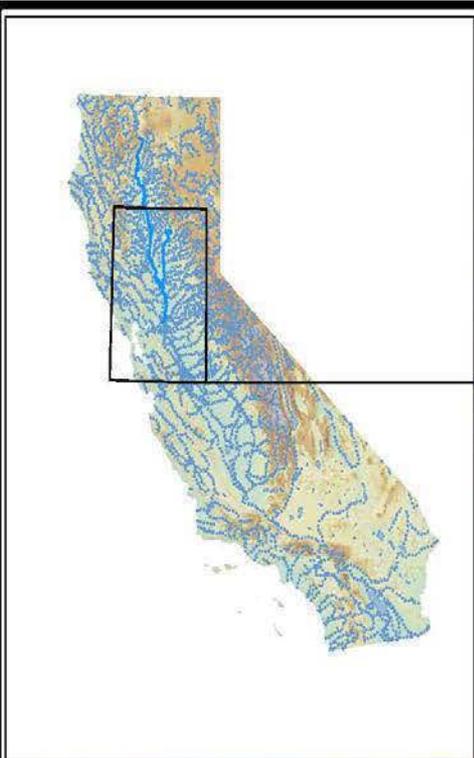
Andrew Hampton and Ryon Kurth



Outline

- Area
- Background
- Previous Studies
- Planned Study
- Methods
- Tagging/Movement
- Stomach Sampling
- Future Considerations





— Feather River



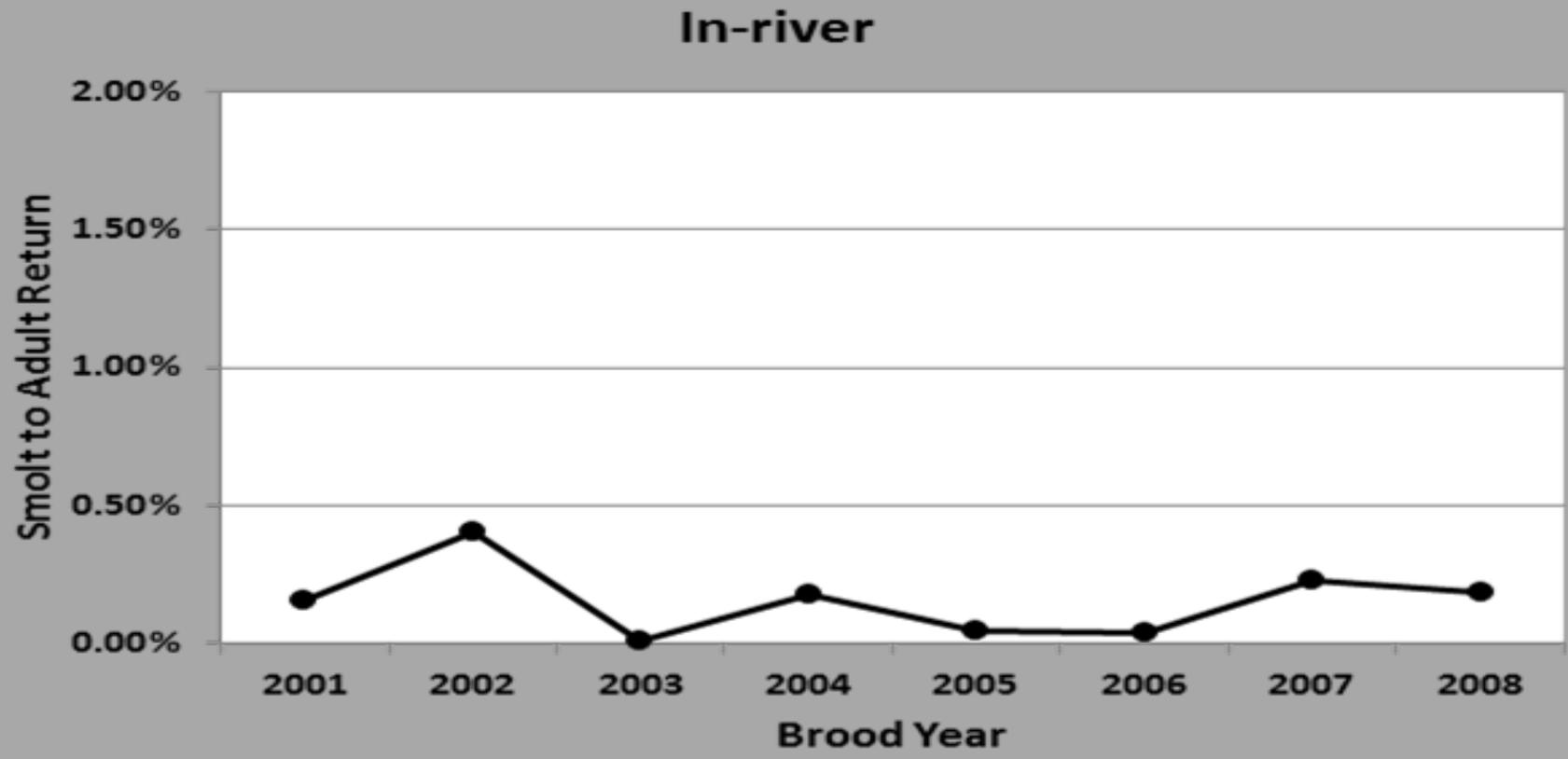
0 25 50 100 Miles

Cartographer: Katie Lentz, November 2016
Source: California Department of Water Resources, Feather River Fisheries Program, 2016
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Why take a look at predators?

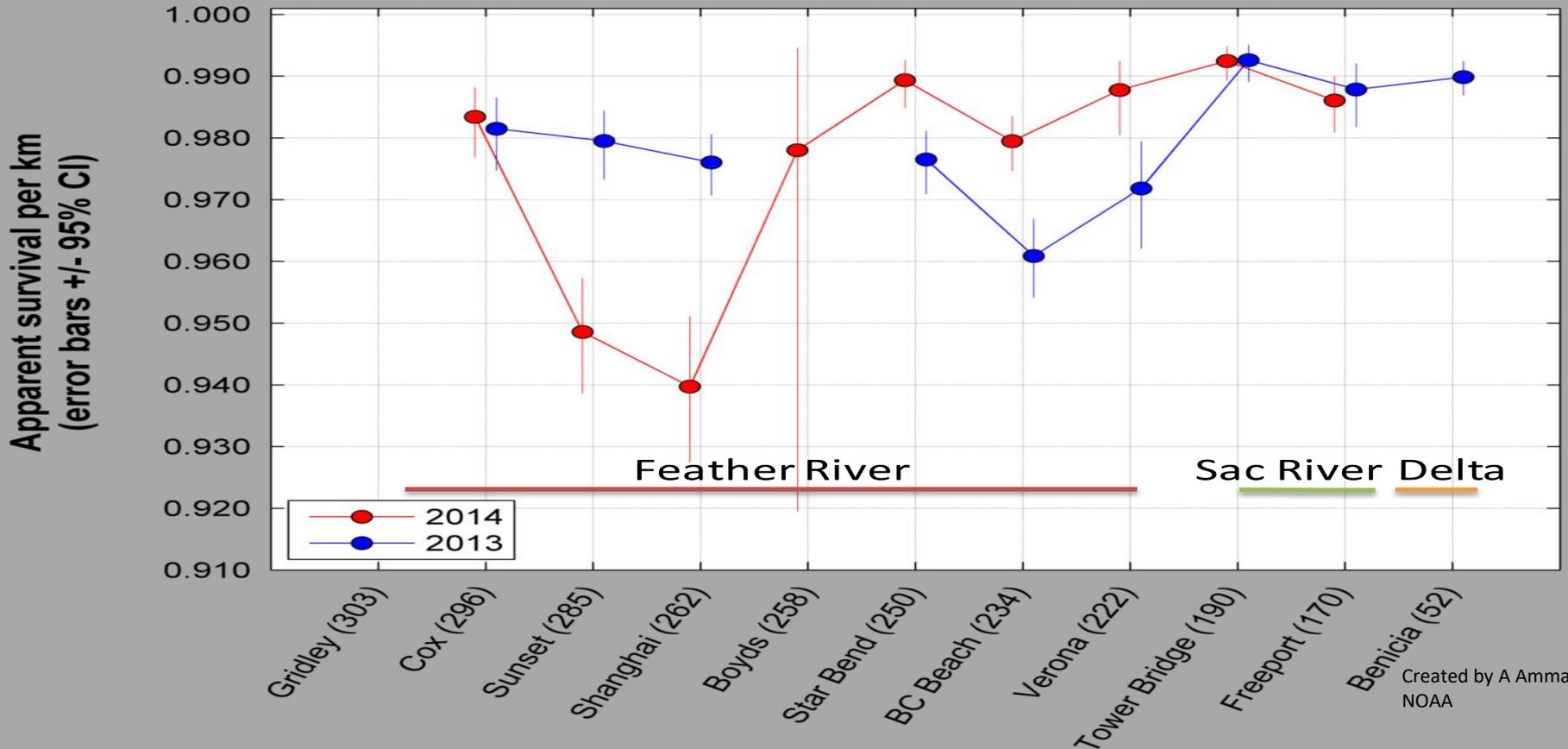
- Already know of poor return rate to hatchery for CVST and Spring run Chinook
 - Both of which are in river released juveniles
 - Observed high estimates of mortality in previous studies
- Patterns in mortality varied annually
 - River conditions at release?
 - Predator presence and/or abundance?

Smolt to adult return rate of in-river released spring run salmon.



Apparent survival of out migrating JSAT tagged spring run smolts.

CJS Modeled Survival: Feather Spring-run Chinook
2013 vs 2014



Original Study Plan

- Mark-recapture study on predators over three years
 - Predator population size
 - Consumption rates
 - Bioenergetics model
- Look at the relationship between acoustic tagged predators and in-river released acoustic tagged juvenile spring run salmon
- Look at diet composition of predators
- Target in-river hatchery release of juvenile salmonids to study predator impact

~~Original Study Plan~~ Actual Study

- ~~Mark-recapture study on predators over three years~~ Low catch numbers
- ~~Predator population size~~ we were not able to capture/recapture enough fish to make an estimate
 - ~~Consumption rates~~ could not calculate
 - ~~Bioenergetics model~~
- ~~Look at the relationship between acoustic tagged predators and in-river released acoustic tagged juvenile spring run salmon~~ Low number of acoustic tagged predators the first year and no funding for further JSAT studies on the Feather moving forward
- Look at diet composition of various predator species throughout the river and across seasons
- Target hatchery release of juvenile salmonids to study impact of predators

Methods

- Acoustic Tagging
 - Captured fish by fyke and angling
 - Targeting Striped Bass
 - Fished January - May
 - Track predator movements

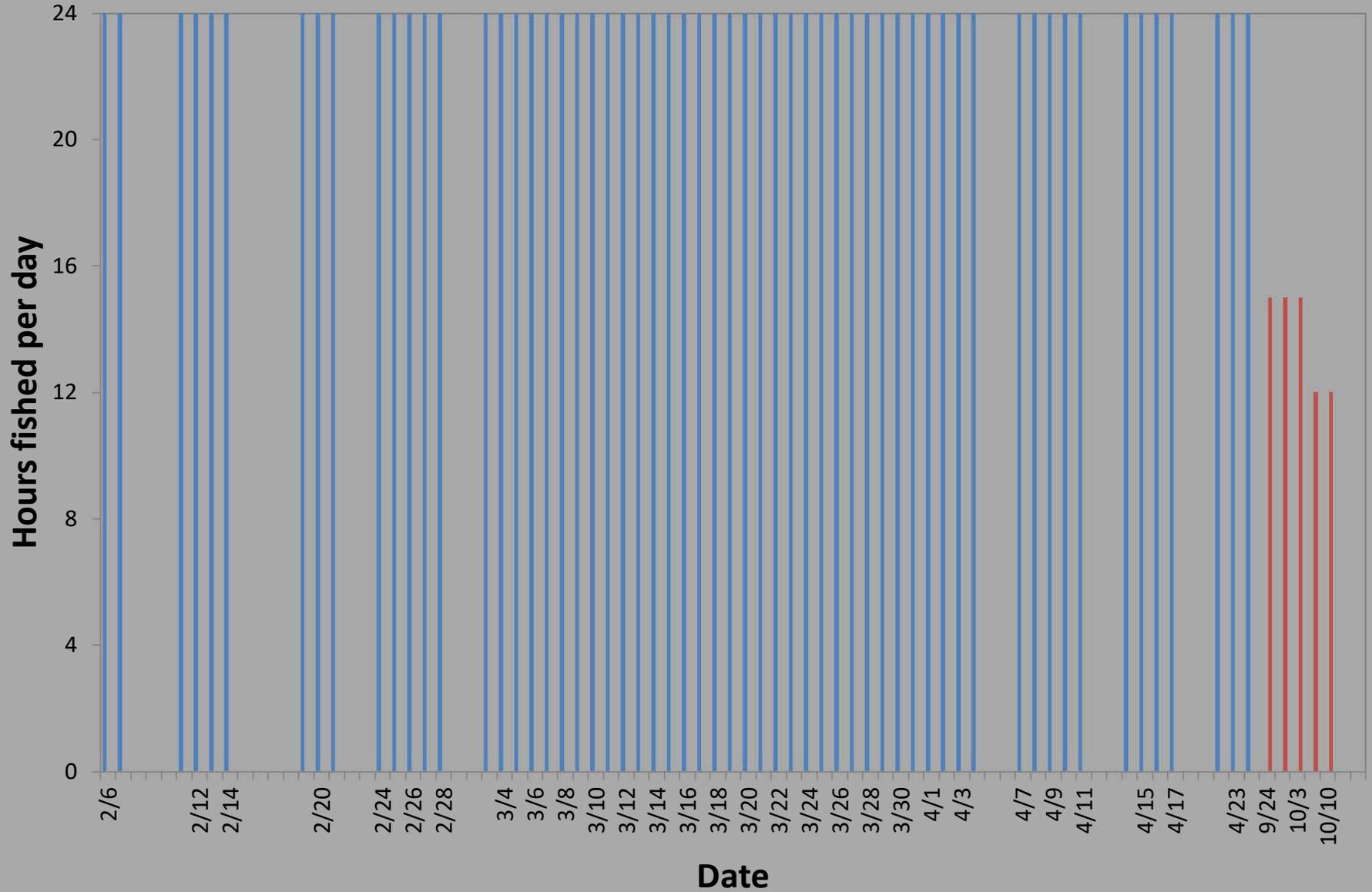


Methods

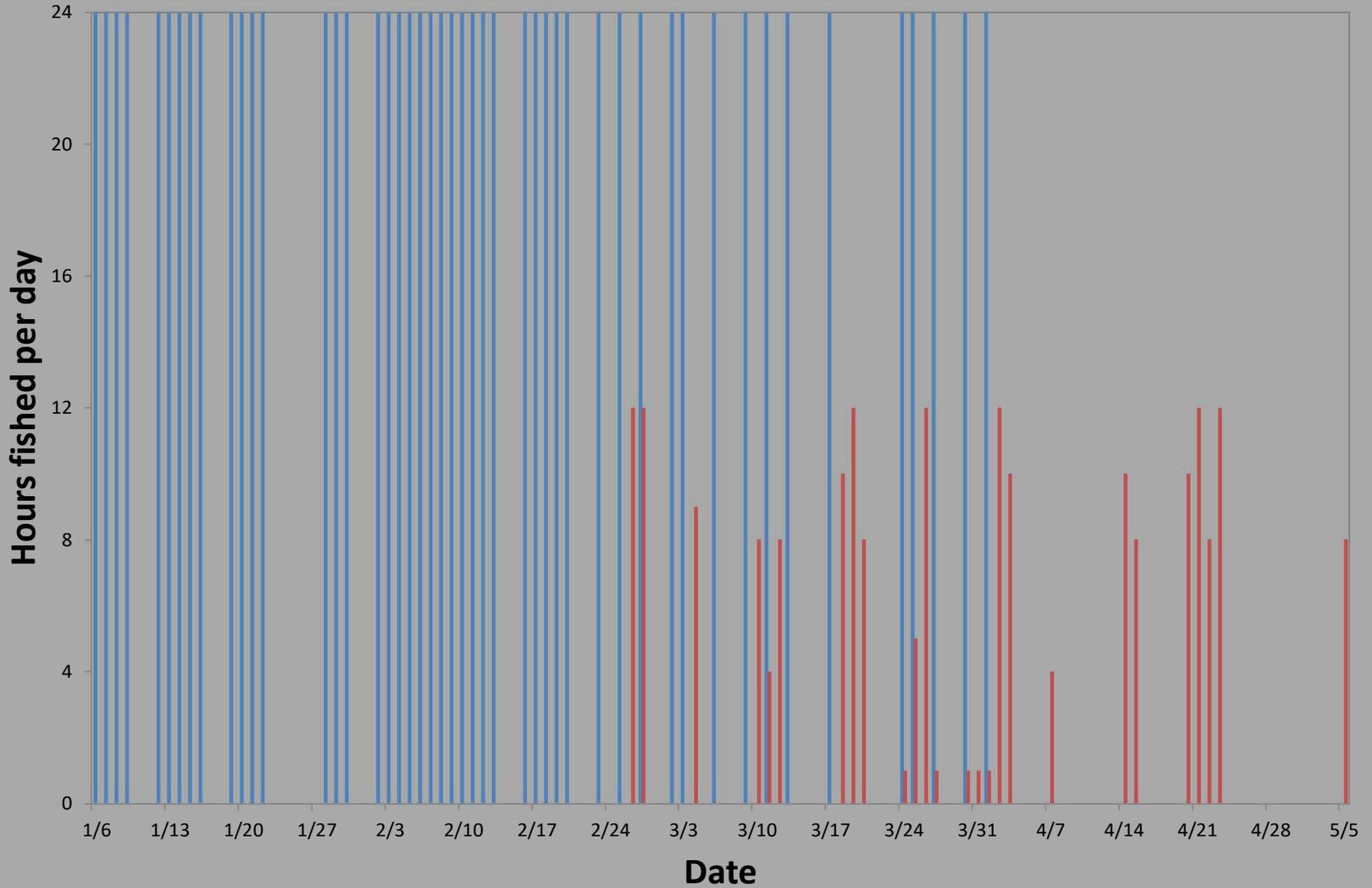
- Diet and Relative Predator Abundance
 - Only angling
 - Seasonal sampling in multiple reaches (2015/2016) & pilot study (2014)
 - ESA permit restrictions on traditional sampling



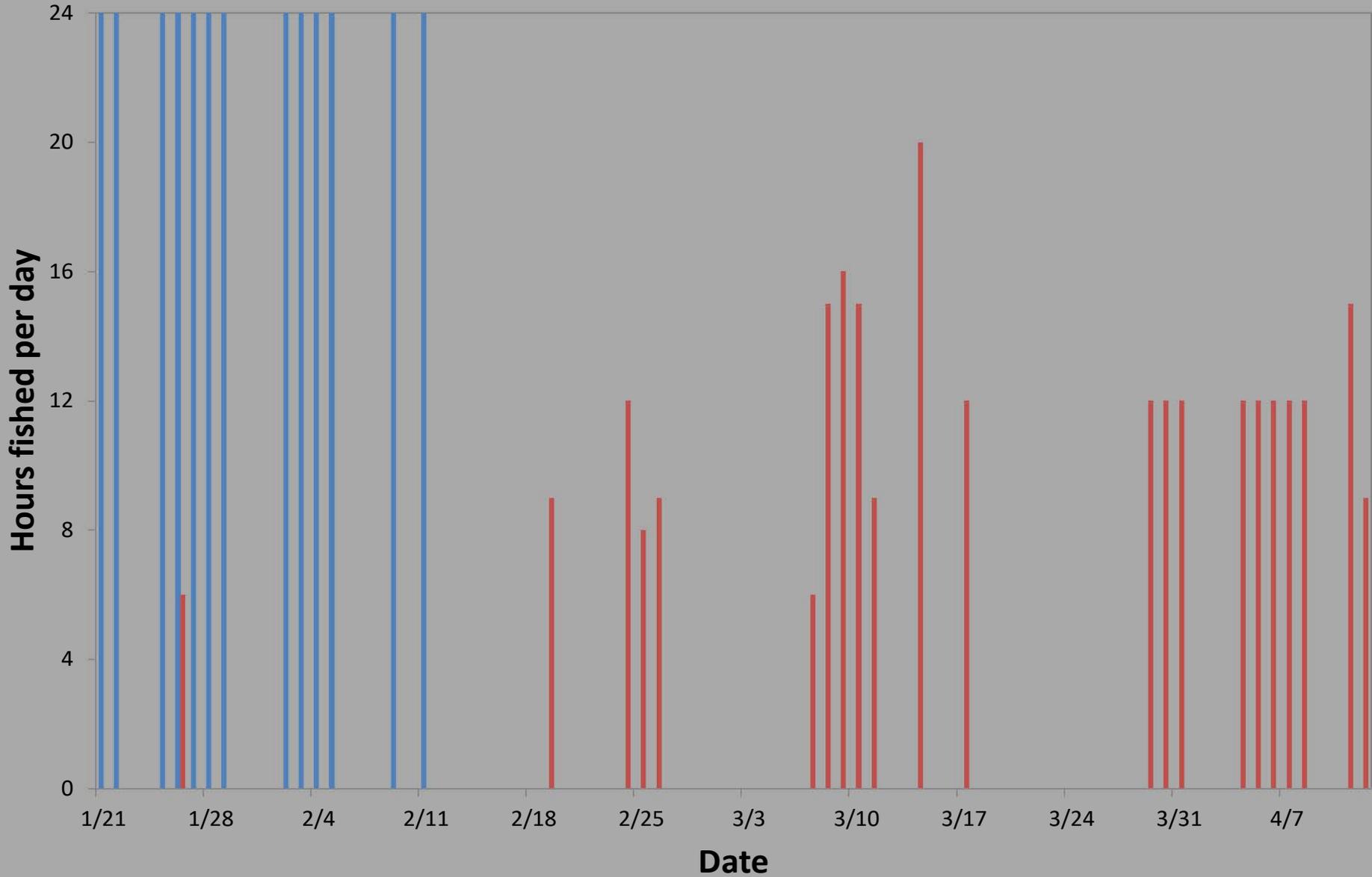
Fyke and Angling Fishing Effort for 2014



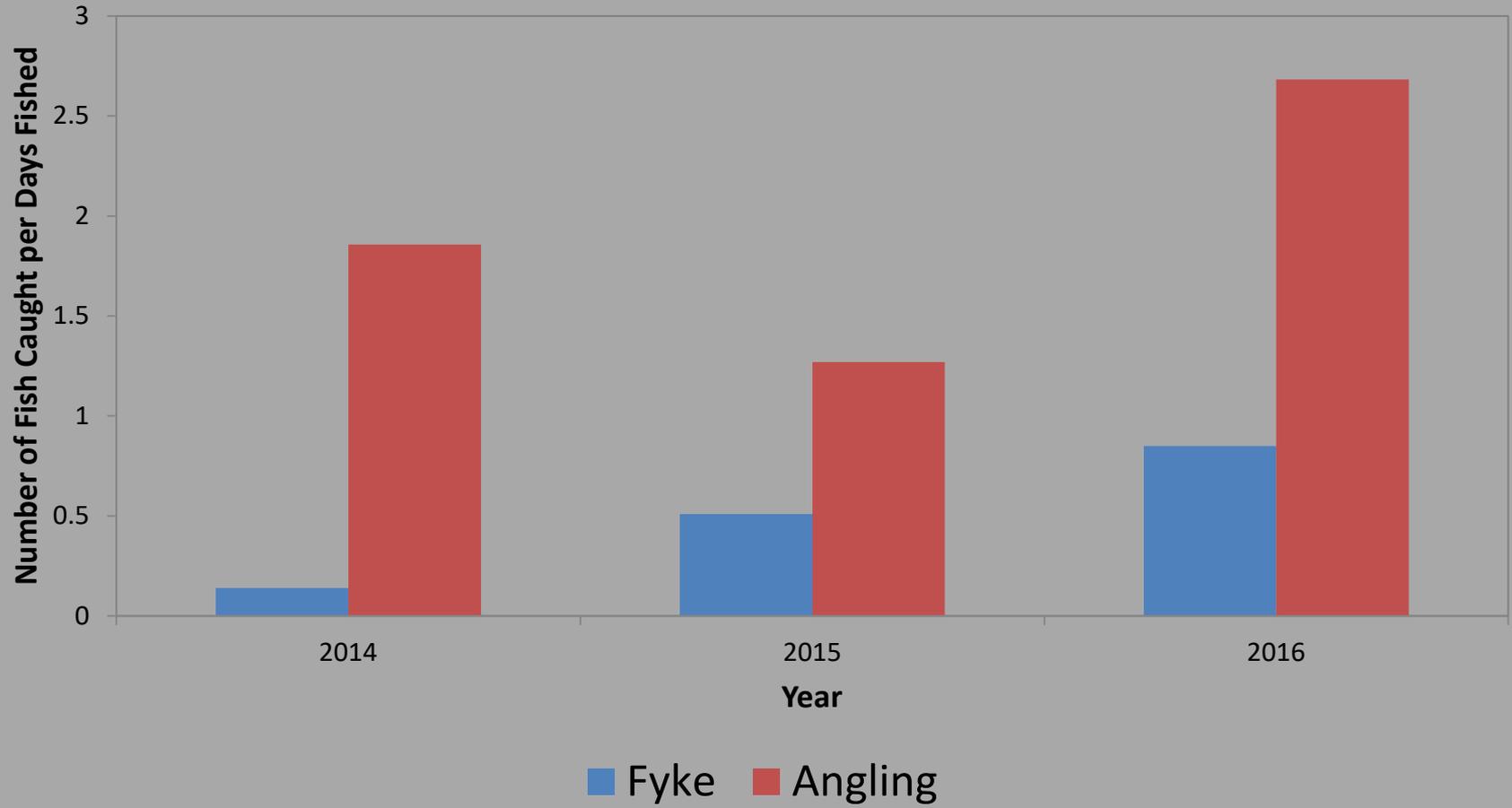
Fyke and Angling Fishing Effort for 2015



Fyke and Angling Fishing Effort for 2016

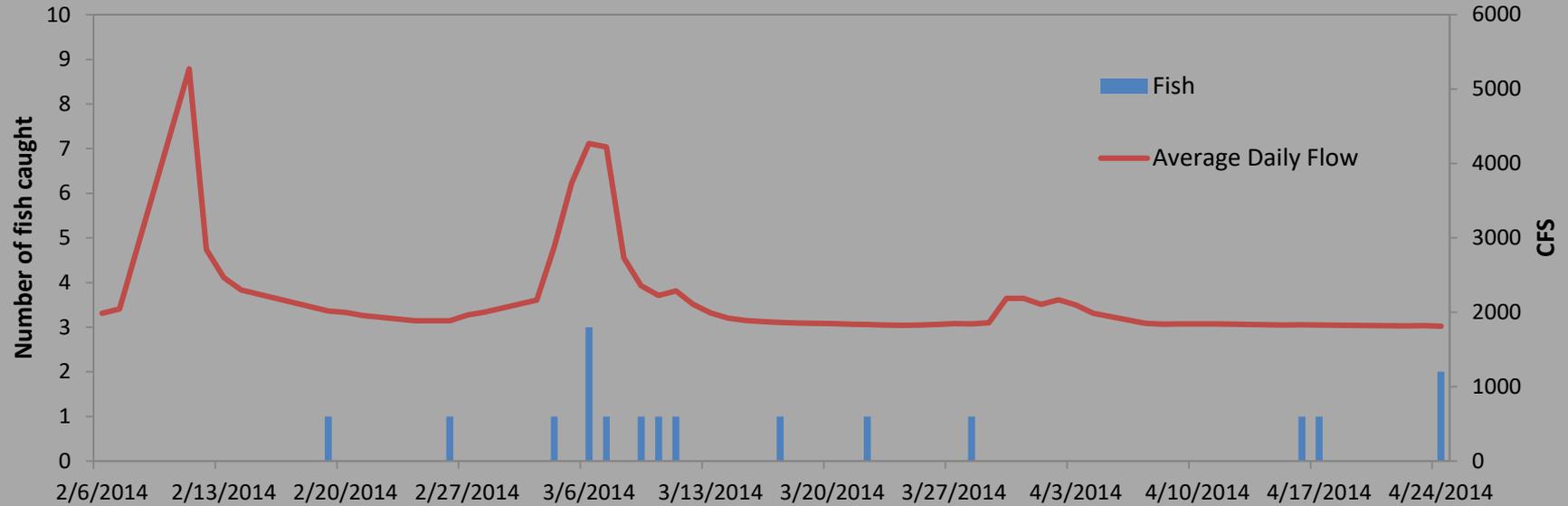


Comparing Catch per Year

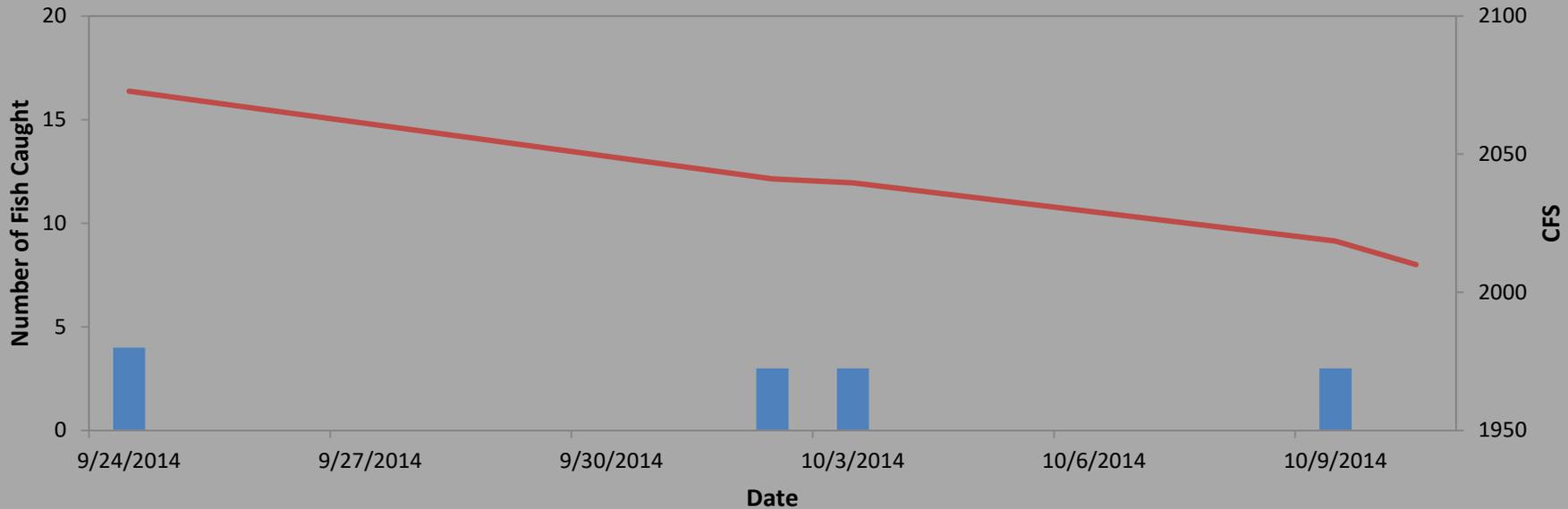


2014 Results for fish caught via Fyke and Angling and associated flow at time of catch

F

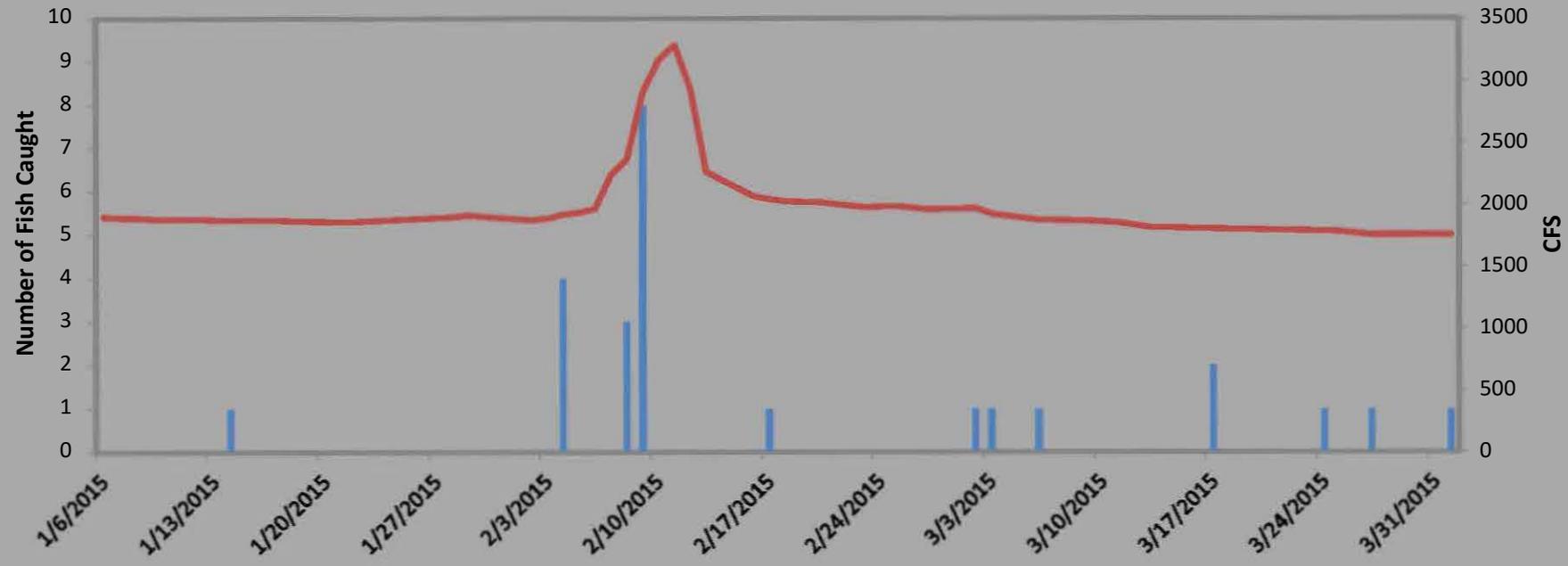


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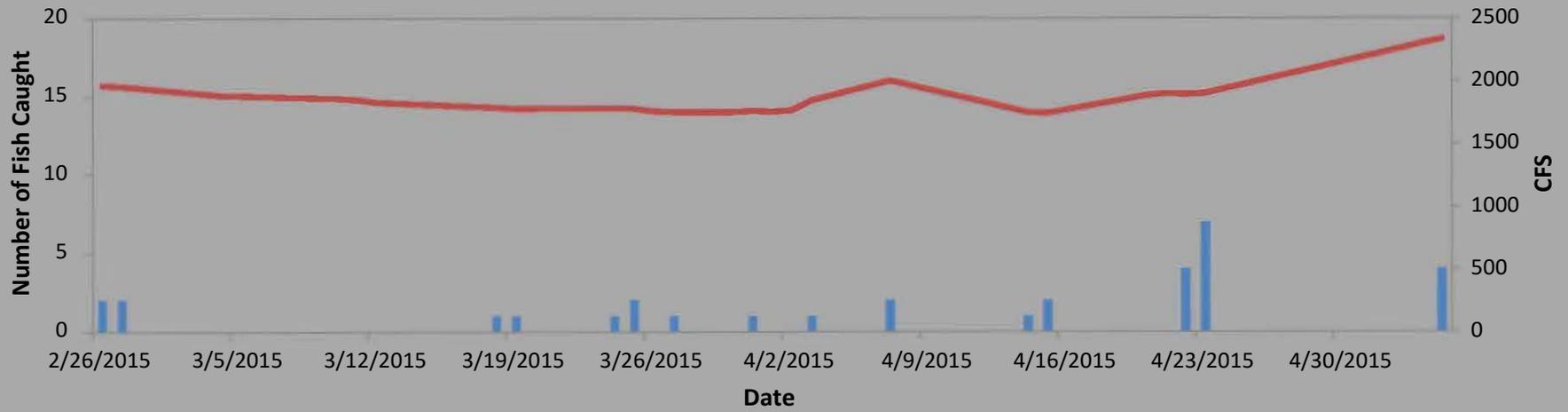


2015 Results for fish caught via Fyke and Angling and associated flow at time of catch

F

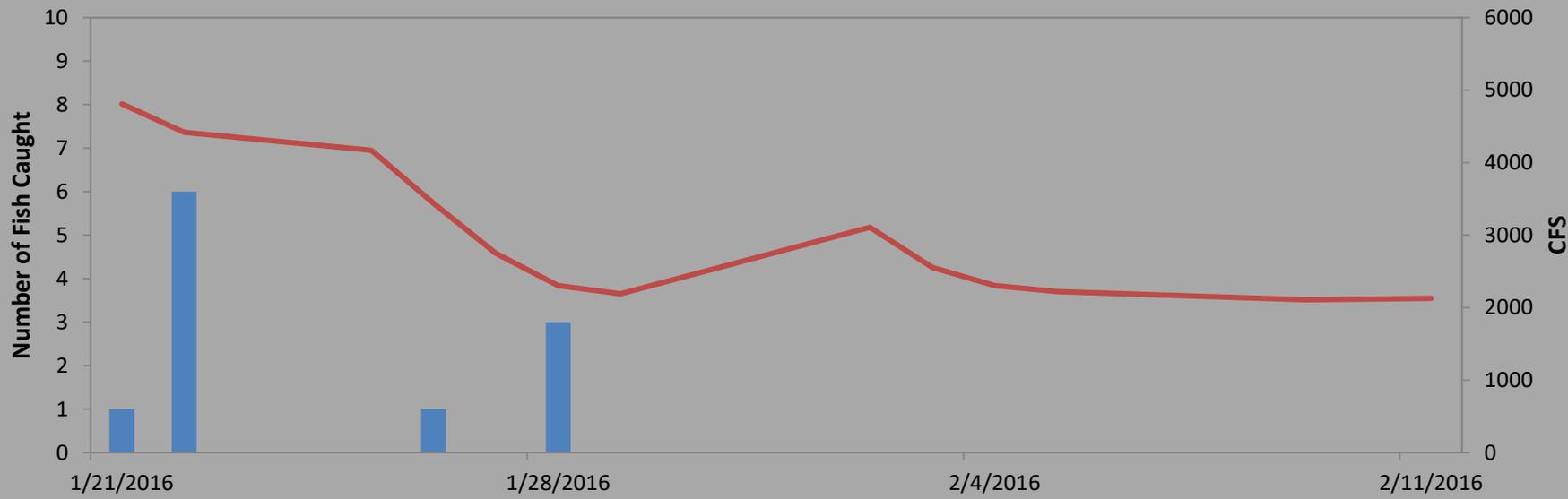


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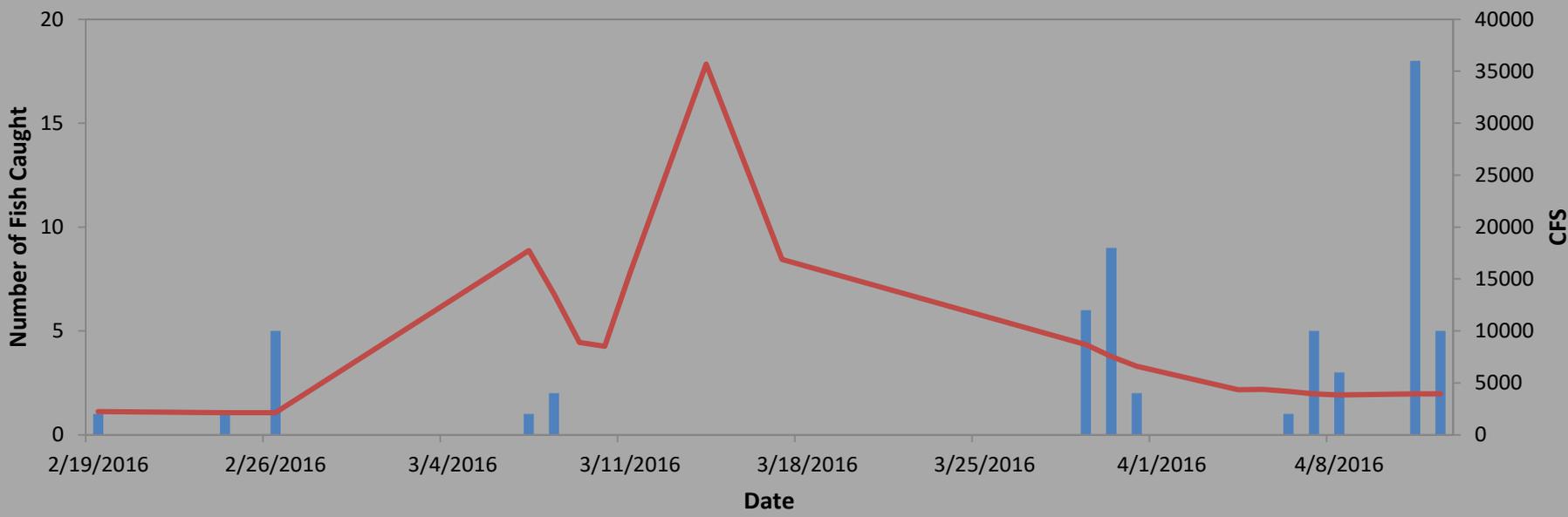


2016 Results for fish caught via Fyke and Angling and associated flow at time of catch

F



A



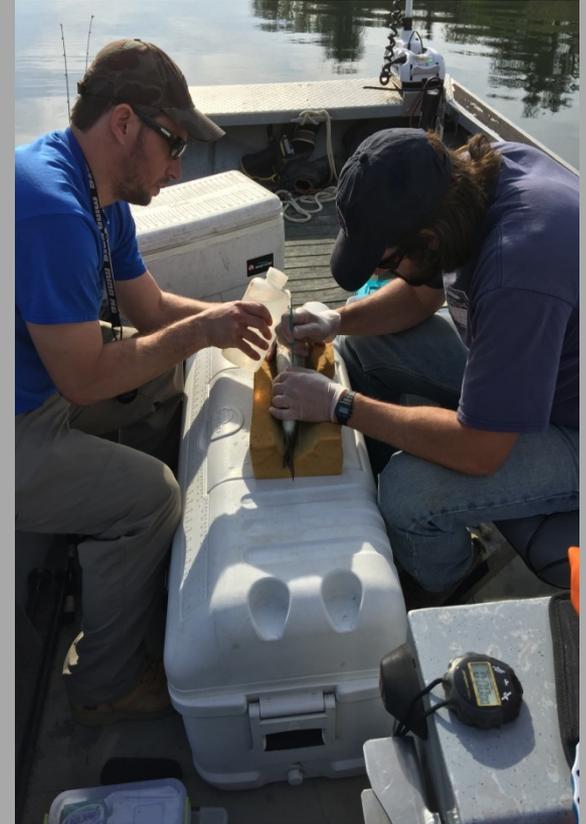
Acoustic Tagging

- 2 year Vemco V13 tags with unique ping rate
 - 60 days at high ping rate, 50-110 seconds
 - 305 days at low ping rate, 120-240



What did we end up tagging?

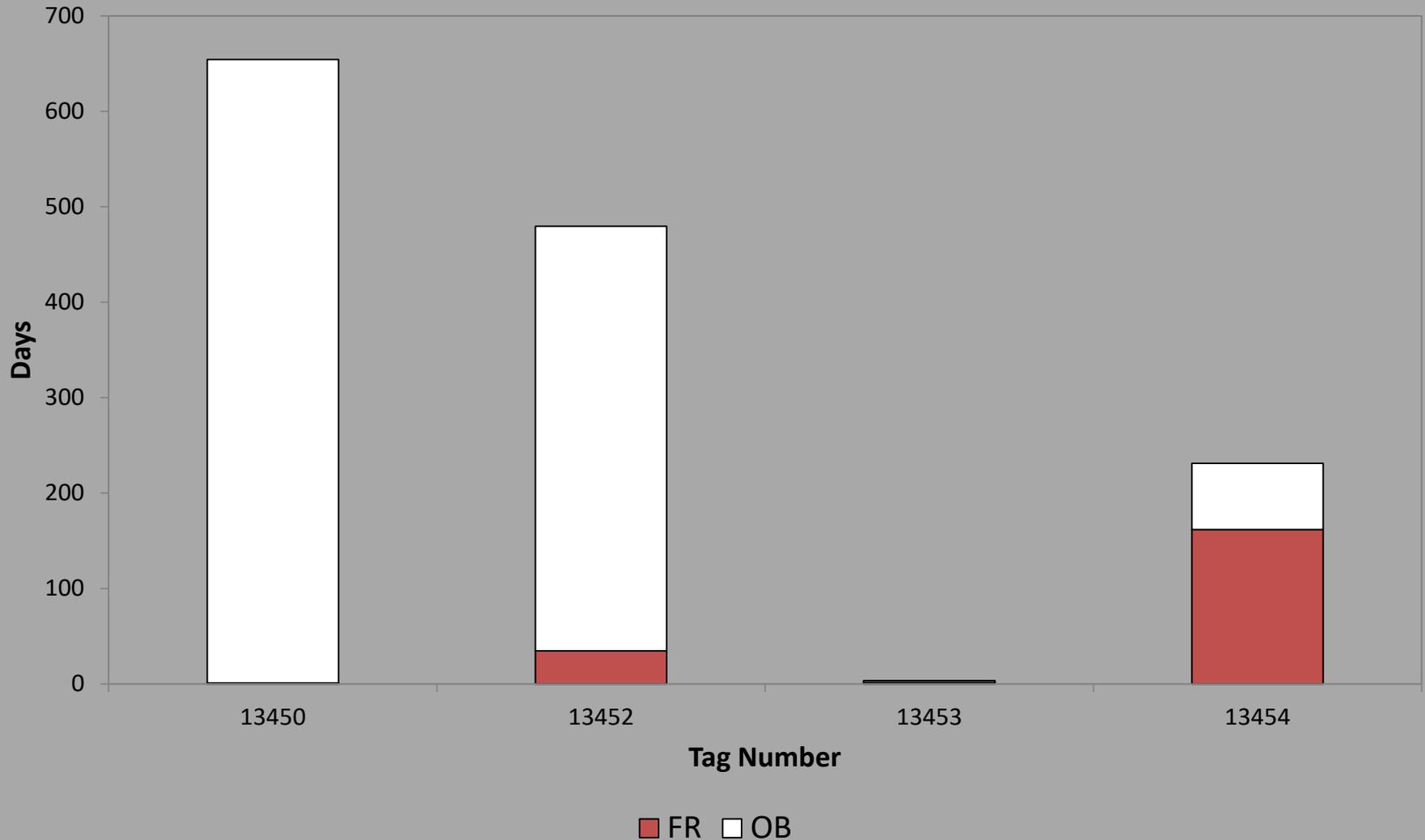
- 64 total fish
 - 49 striped bass (77%)
 - 7 largemouth bass (11%)
 - 6 Sacramento Pikeminnow (9%)
 - 2 catfish(3%)



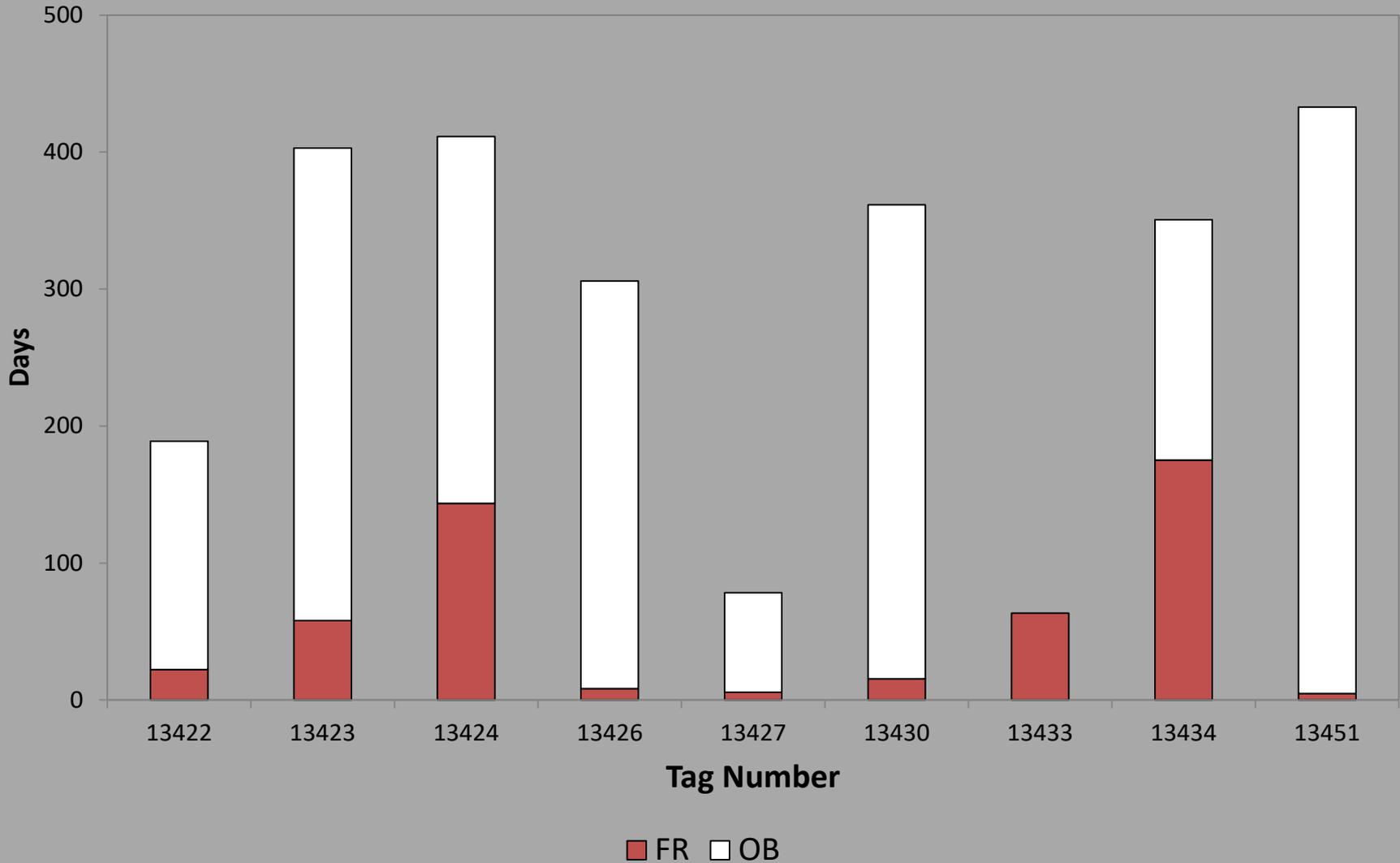
Predator Movement

- Most Striped bass moved out of the Feather quickly after being tagged
- Primarily caught and stayed in the lower river
- Other predators traveled very short distances and for the most part stayed within the reach they were tagged

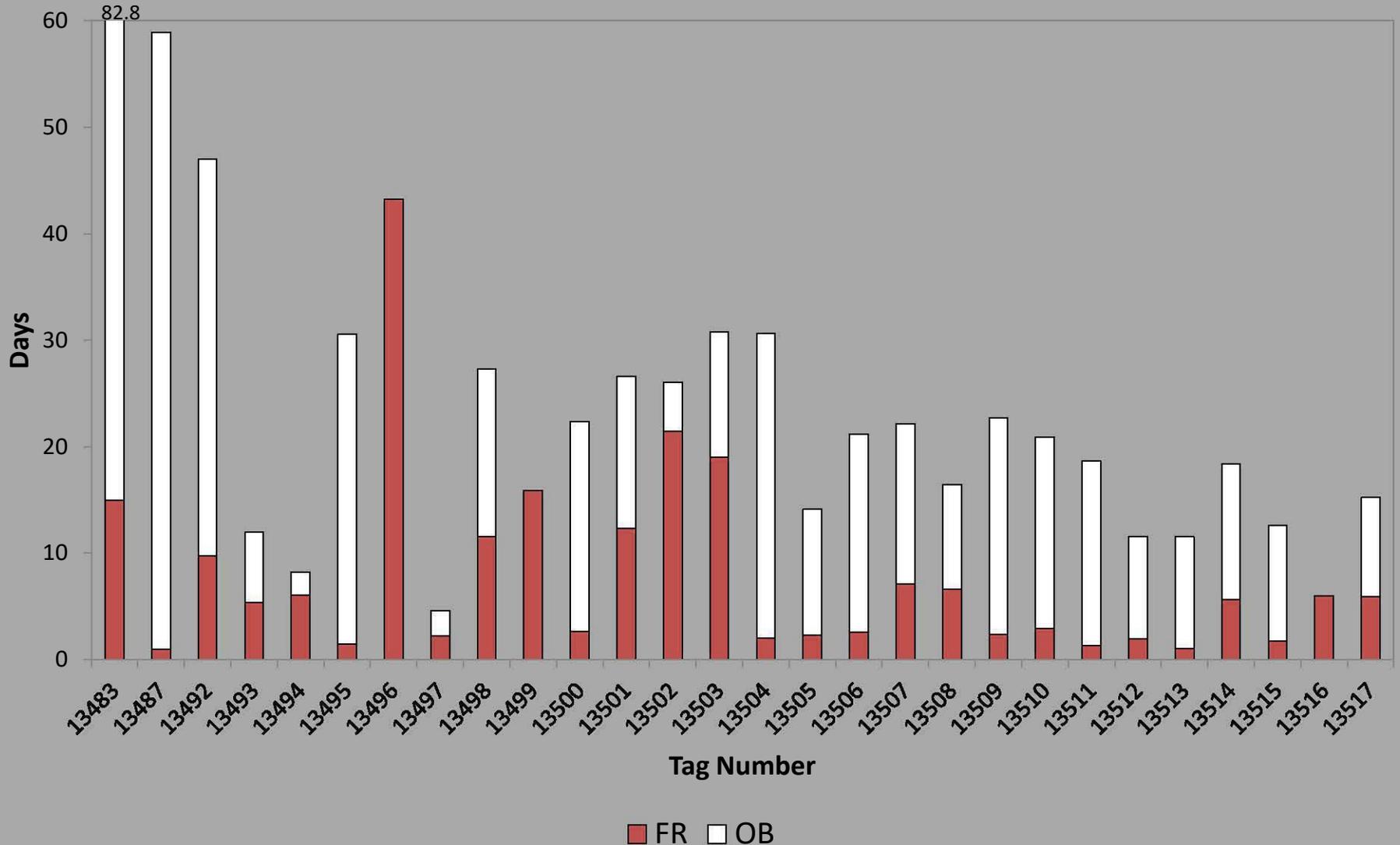
Amount of total time at liberty Striped bass spent within the Feather River in **2014**.



Amount of total time at liberty Striped bass spent within the Feather River in **2015**.

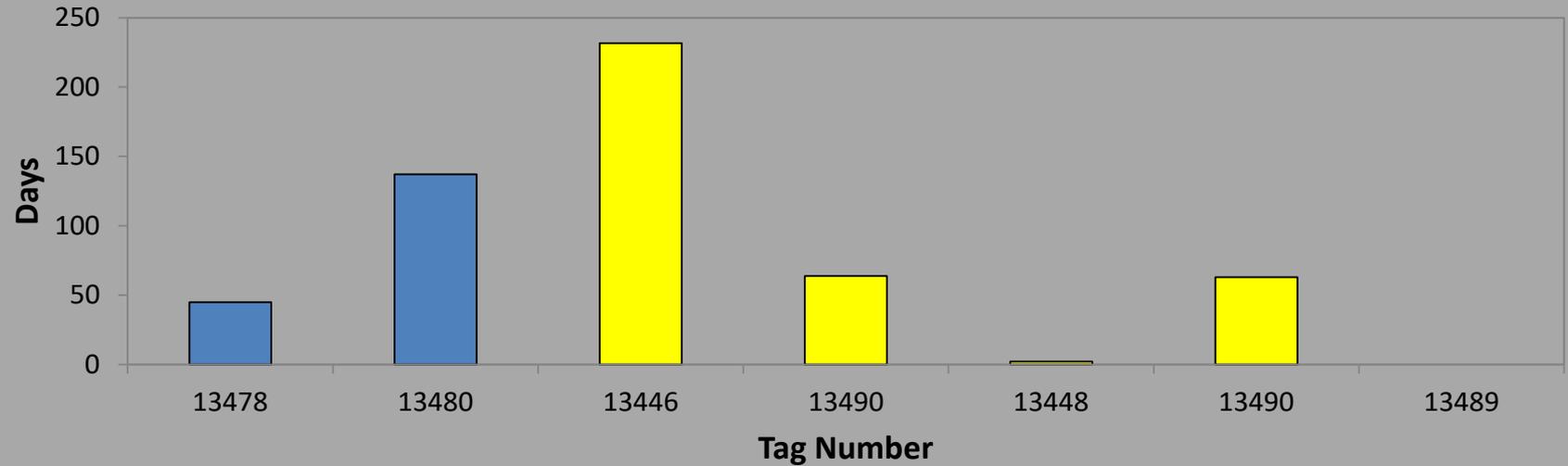


Amount of total time at liberty Striped bass spent within the Feather River in **2016**.



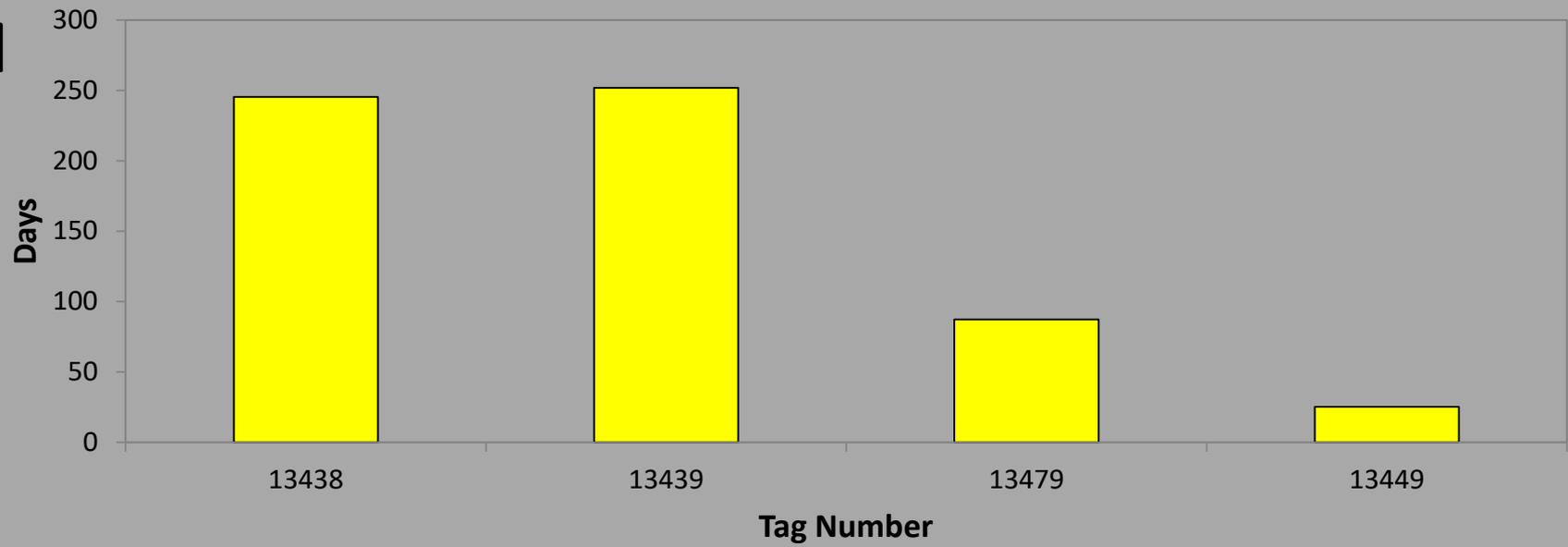
Amount of total time at liberty Large Mouth bass and Sacramento Pikeminnow spent within the Feather River and the areas they inhabited.

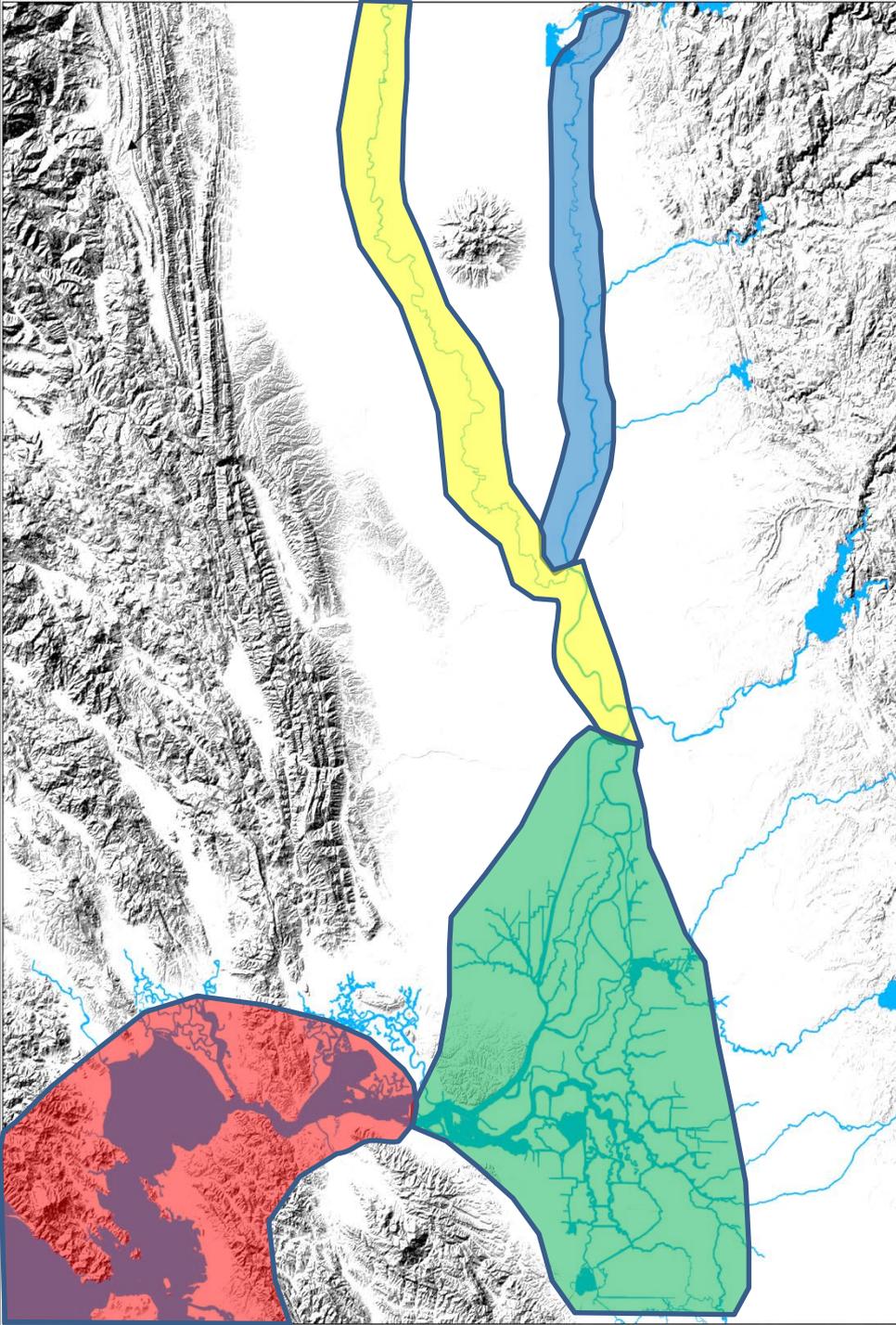
BB



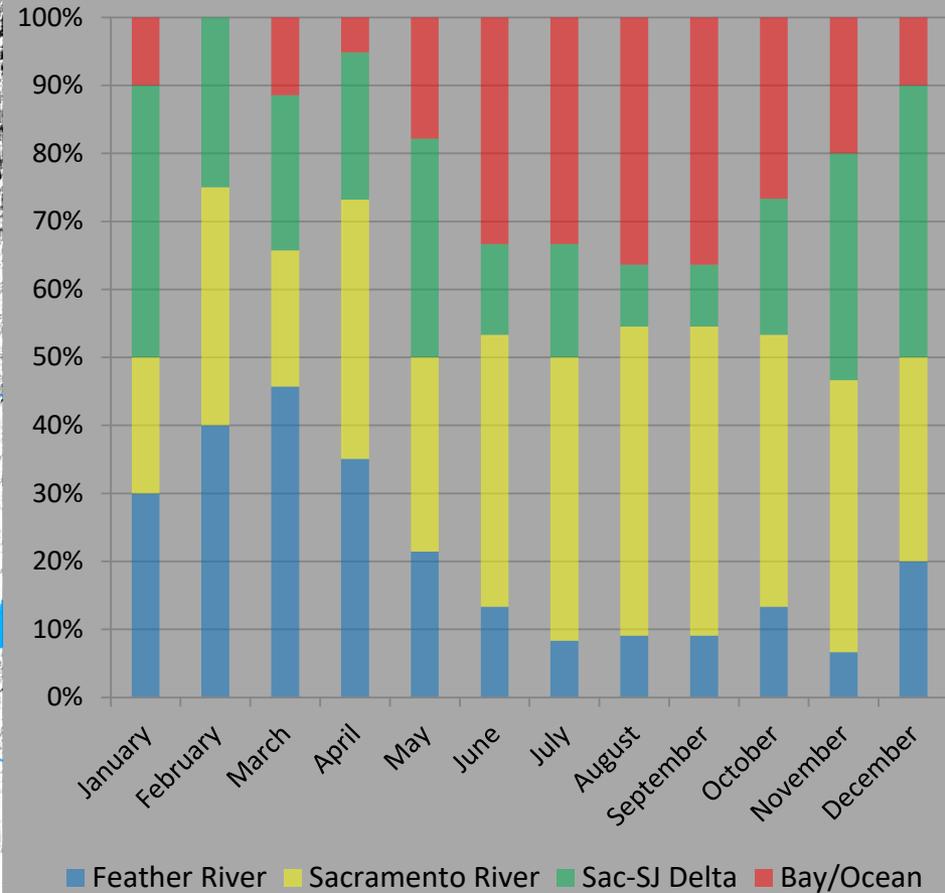
River Section 1 2 3 4

PM

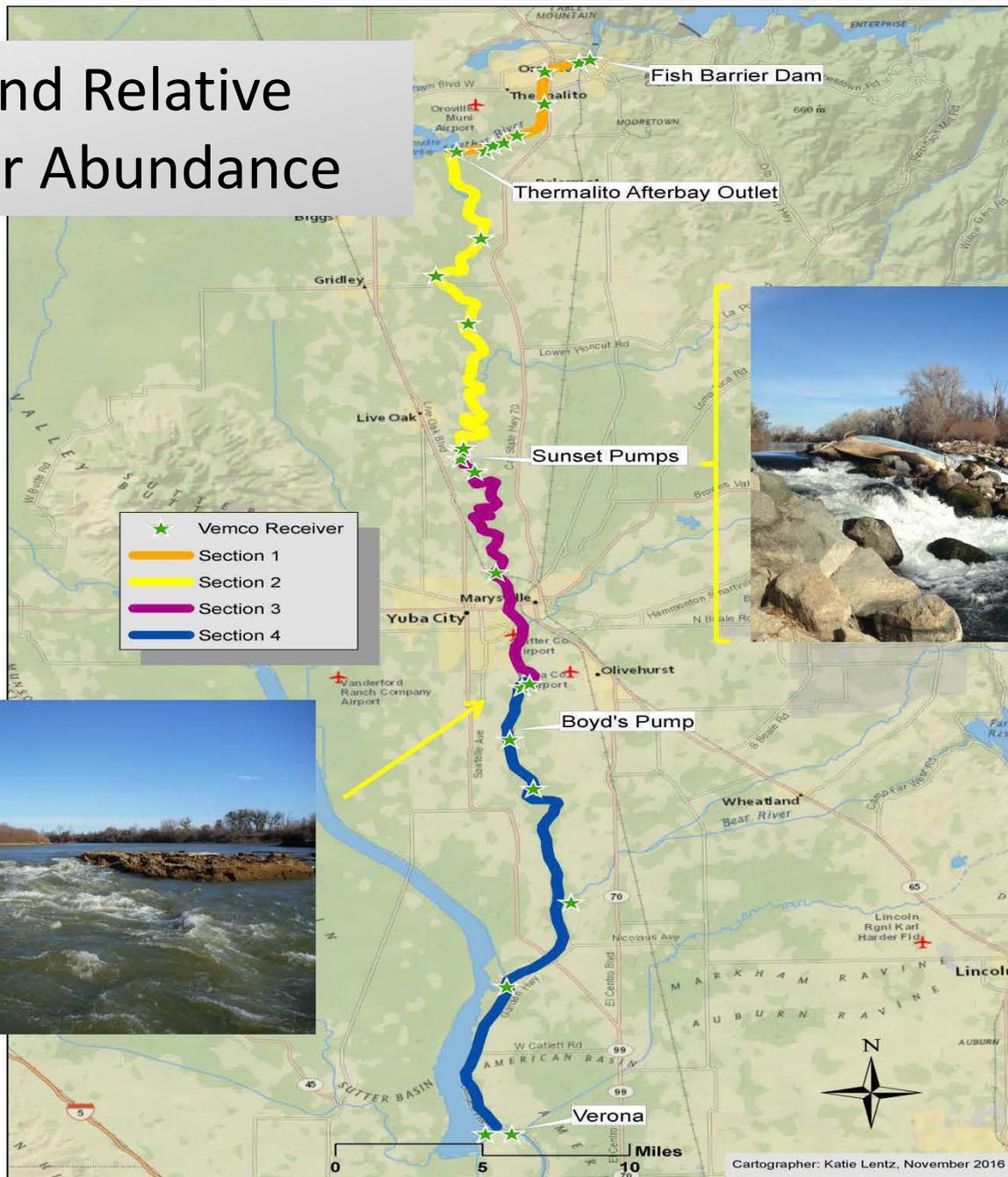




Percentage of tagged Striped bass which were found in separate sections per month and how long they were in those sections.



Diet and Relative Predator Abundance



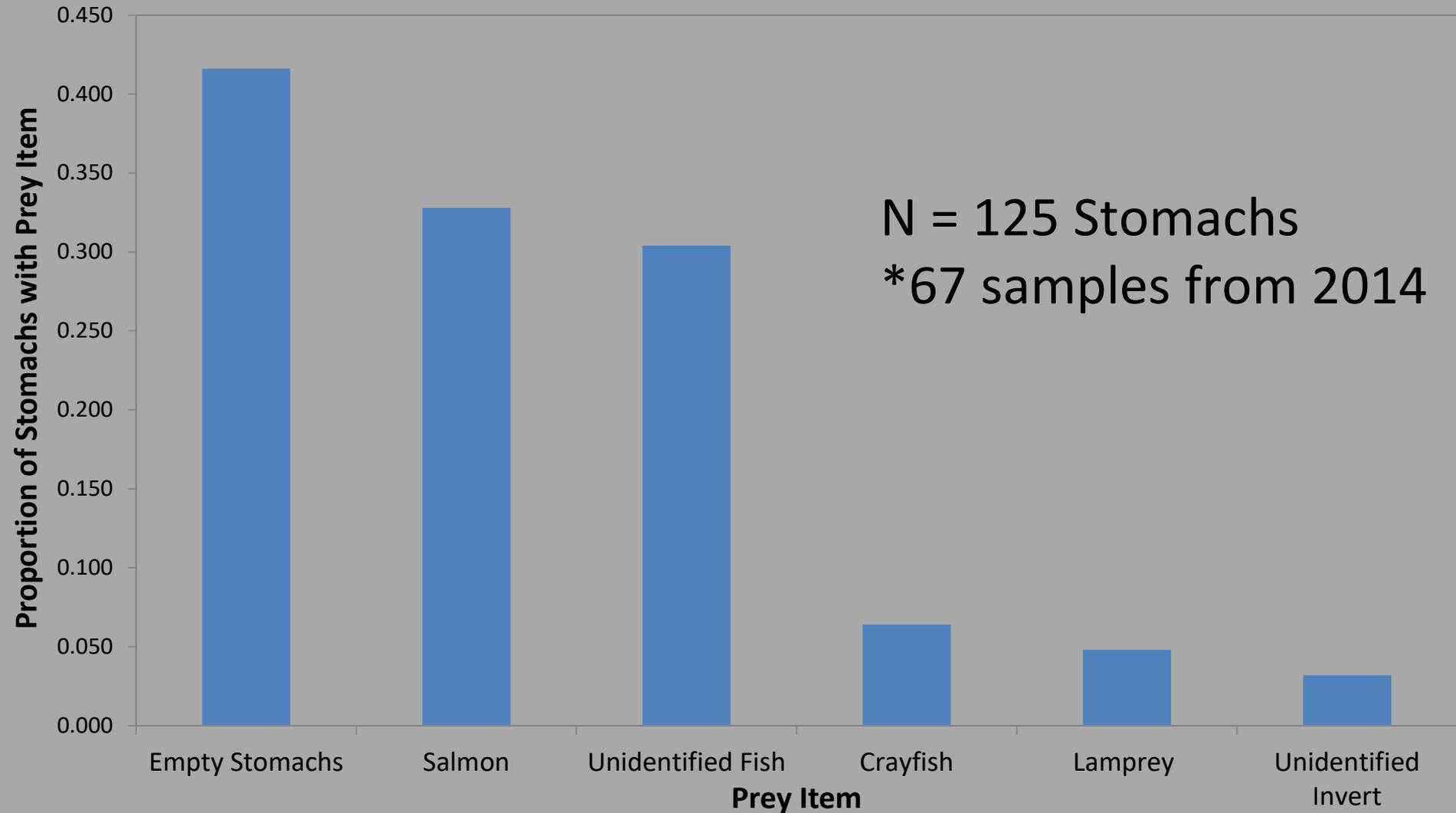
Percent occurrence of catch per species by **section**.

Species	Section				Total number of fish caught: 174
	1	2	3	4	
Striped Bass	0	0	5%	95%	60
Micropterus	2%	54%	18%	27%	56
Sacramento Pikeminnow	7%	77%	14%	2%	43
Ictaluridae	0	0	0	100%	3
Central Valley Steelhead Trout	100%	0	0	0	12

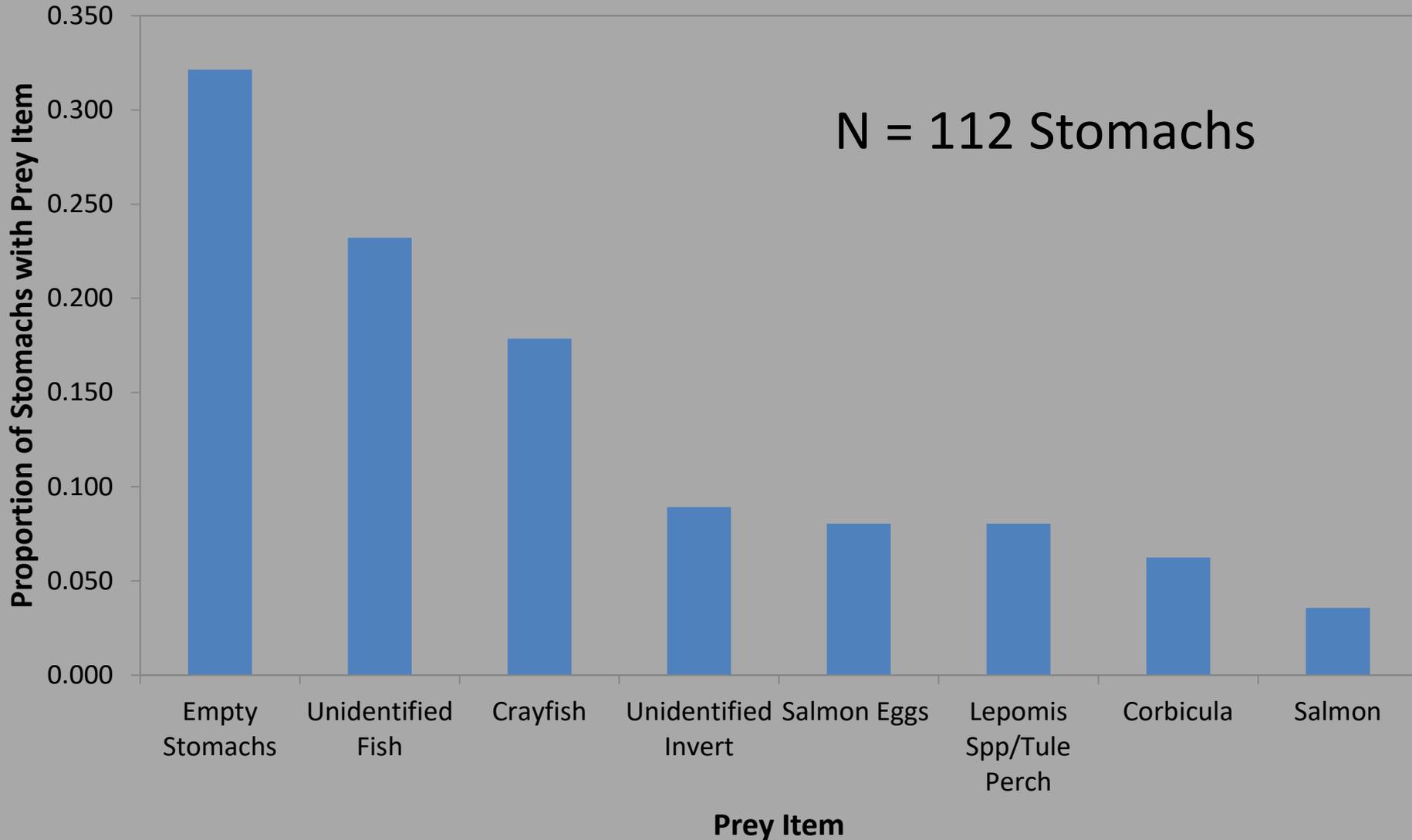
Percent occurrence of catch per species by **season**.

	Summer	Fall	Winter	Spring	Total number of fish caught: 174
Striped Bass	29%	2%	0	69%	60
Micropterus	29%	39%	21%	11%	56
Sacramento Pikeminnow	44%	33%	2%	21%	43
Ictaluridae	33%	0	67%	0	3
Central Valley Steelhead Trout	0	75%	8%	17%	12

Food item occurrence in Striped bass (*Morone saxatilis*) from 2014-2016



Food item occurrence in non Striped bass predators from 2014-2016.





Hatchery Releases

- Spring sampling effort in the lower river sections coincided with hatchery release
- 1-2 Million hatchery origin spring run Chinook young of the year
- 100% CWT marked

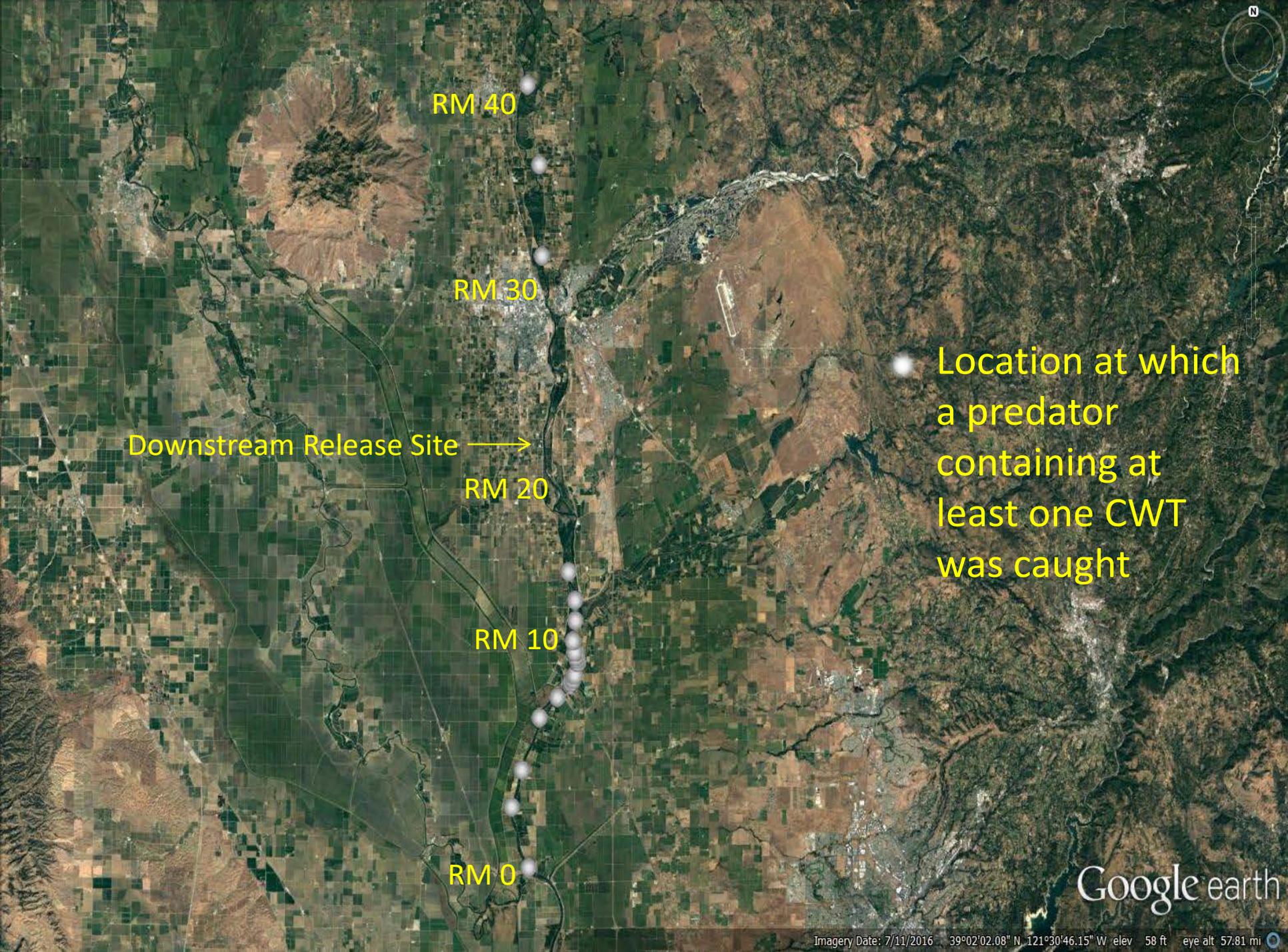


CWT Recovery



Breakdown of CWT recovery by predator species.

Species	Percent of stomachs that contained CWTs (# of tags)
Striped Bass	24% (140)
Micropterus	3% (3)
Ictaluridae	0
Sacramento Pikeminnow	0



RM 40

RM 30

Downstream Release Site →

RM 20

RM 10

RM 0

Location at which a predator containing at least one CWT was caught

Non Striped Bass
Predators

RM 40

RM 30

Downstream Release Site →

RM 20

RM 10

Striped Bass

RM 0

Location at which
a predator
containing at
least one CWT
was caught

Google earth

Summary table for the six spring run salmon releases from which we recovered CWT's.

Release Location	River Mile at Release	Number of CWTs recovered	Average distance in miles from release caught (rm)	Average time from release caught(days)
Gridley	50.5	4	22.5 (28)	7
	50.5*	1	45.7 (4.8)	6
Boyd's Pump	22.5	5	11.7 (10.8)	1
	22.5*	16	23.6 (1.1)	5
	22.5	1	11.5 (11)	22
	22.5	114	11.7 (10.8)	1

* Indicates fish caught in 2014

Non Striped Bass
Predators

RM 40

RM 30

Downstream Release Site →

RM 20

RM 10

Striped Bass

RM 0

Location at which
a predator
containing at
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was caught

Google earth

Conclusions

- Striped bass did not reside in the Feather River year round
- Upper reaches dominated by Micropterus and Pikeminnow while lower reaches dominated by Striped bass
- Striped bass were main consumer of hatchery and natural origin salmon
- Lower river is a dangerous place to be a smolt during the years that we sampled

Looking Forward

- How can we alter releases of hatchery fish to reduce effects of predators?
 - Release timing
 - Discharge
- Is there a discharge that would be beneficial for juvenile emigration but not Striped bass migration?

Thank You



Thank You

